

CLAIMS

1. A lithium secondary battery negative electrode having a thin film of silicon oxide formed by vacuum vapor deposition or sputtering on a surface of a collector.

2. The lithium secondary battery negative electrode according to claim 1, wherein a thickness of the thin film of silicon oxide is in the range of from 0.1 to 50 μm .

3. The lithium secondary battery negative electrode according to claim 1, wherein the vacuum vapor deposition is an ion plating method.

4. The lithium secondary battery negative electrode according to claim 1, wherein the silicon oxide is SiO_x ($0.5 \leq x \leq 1.2$).

5. The lithium secondary battery negative electrode according to claim 4, wherein the silicon oxide is SiO_x ($0.5 \leq x < 1.0$).

6. A lithium secondary battery negative electrode, being an SiO film type negative electrode obtained by forming a silicon oxide film as a negative electrode active material on a surface

of the collector and having a capacity sustainability in discharge in the tenth time of 98% or more.

7. A lithium secondary battery having an negative electrode according to any of claims 1 to 6.

8. A film forming material, used in forming a thin film of silicon oxide of a lithium secondary battery negative electrode with vacuum vapor deposition or sputtering, and being a deposit of SiO or a sintered compact produced from the deposit.

9. The film formation material according to claim 8, being the sintered compact and having an evaporation residue when a thermogravimetric measurement on a sintered compact sample is conducted in a vacuum atmosphere under a pressure of 10 Pa or less at a temperature of 1300°C of 4% or less of the mass of the sample before the measurement.

10. The film formation material according to claim 8, being a powder sintered compact and having an average particle diameter of powder thereof of 250 μm or more.

11. The film formation material according to claim 8, being a deposit of SiO and having a weight decrease percent (a rattler value) in a rattler test of 1.0% or less.

12. A fabricating method for a lithium secondary battery negative electrode forming a thin film of silicon oxide on a surface of a collector by vacuum vapor deposition or sputtering.

13. The fabricating method for a lithium secondary battery negative electrode according to claim 12, using an ion plating method, which is a kind of the vacuum vapor deposition.

14. The fabricating method for a lithium secondary battery negative electrode according to claim 12, using a film formation material according to any of claims 8 to 11 as a film formation material in the vapor deposition or sputtering.

15. A fabricating method for a lithium secondary battery negative electrode, wherein in formation of a thin film of silicon oxide as a negative electrode active material on a surface of the negative electrode collector, the surface of the collector is applied with a cleaning treatment in a vacuum or an inert atmosphere and thereafter, film formation with silicon oxide is performed on the surface of the collector without exposing the surface of the collector to the air atmosphere.

16. The fabricating method for a lithium secondary battery negative electrode according to claim 15, using a vacuum

vapor deposition method or a sputtering method as a formation method for a silicon oxide film.

17. The fabricating method for a lithium secondary battery negative electrode according to claim 15, using an SiO deposit as a film formation material in forming a silicon oxide film.